liamentary copies Nos. 1 and 2 of the standard pound, and two auxiliary platinum weights together, equal to about 1432·35 grains. The mean result of 60 comparisons was to find the Kilogramme des Archives epual to 15432·34813 grains. But Prof. Miller was not satisfied with this result, as one of the auxiliary weights was found to contain a small cavity filled with some hygroscopic substance, which rendered its weight slightly variable. He therefore considered it requisite to make further comparisons directly with the English standard pound.

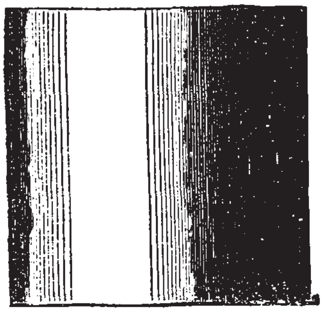

FIG. 12.—Platinum Kilogram 𝔈.

For this purpose, a platinum kilogram, constructed by Gambey, was procured at Paris by Prof. Miller, and was accurately compared by him with the Kilogramme des Archives. This platinum kilogram, designated as 𝔈 by Prof. Miller, is similar in form to the prototype, but is a little smaller, in consequence of the somewhat greater density of the platinum of which it is composed. Its density was determined by hydrostatic weighings to be 21·13791. From the mean of 100 direct comparisons with the Kilogramme des Archives, 𝔈 was found to be lighter in a vacuum than the French standard by 1·56 mgr. (0·02412 gr.). For ascertaining the weight of 𝔈 in terms of the new imperial standard pound, Prof. Miller subsequently compared this kilogram with the imperial standard pound, together with each of its Parliamentary copies successively, and one of four auxiliary platinum weights, each of 1432·324 grains, constructed for the purpose, and accurately verified in terms of the imperial standard, by means of supplementary platinum weights. The mean result of 166 direct comparisons of 𝔈 was to find its value = 15432·32462 grains. The Kilogramme des Archives was consequently determined to be equal in a vacuum to 15432·34874 imperial grains, or 2·20462125 standard platinum lb.; and the imperial standard pound equal to 453·5926525 metric grammes. These equivalents have since been generally accepted, and were legalised in this country by the Metric Act, 1864.

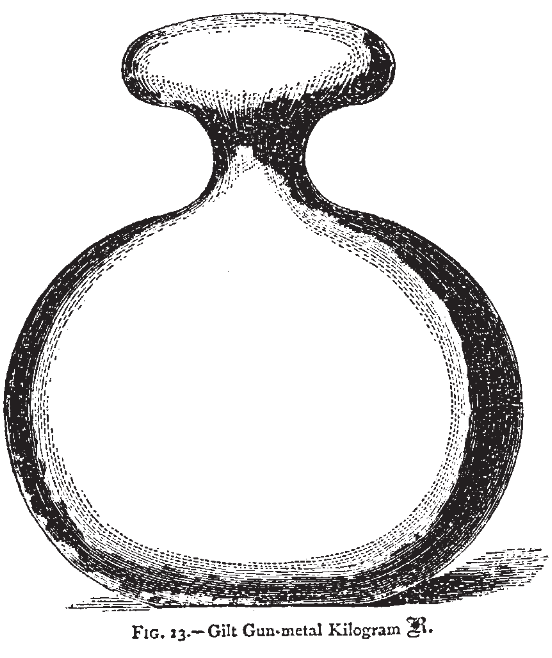

FIG. 13.—Gilt Gun-metal Kilogram ℜ.

The platinum kilogram 𝔈 has since been deposited in the Standards Department, together with a second kilogram, of gilt gun metal, also made under Prof. Miller's directions, and intended as a standard for the adjustment of commercial metric weights, like the French *kilogramme laiton* deposited at the Ministère de l'Intérieure at Paris. This gilt gun metal kilogram was constructed by Oertling and has been denoted as ℜ by Prof. Miller. Its form is spherical with a knob. Its density is 8·3291°. The mean result of 24 comparisons with 𝔈 showed that in a vacuum the weight of ℜ was 1·47 mgr. less than 𝔈, and 3·04 mgr. less than the Kilogramme des Archives. In standard air (*t.* = 18°·7 C., *b.* = 755·64 mm.) ℜ displaced 143·92 mgr. and the Kilogramme des Archives 58·36 mgr. ℜ was then found to be 88·6 mgr. lighter in air than the French platinum prototype, and only 0·06 mgr. lighter than the French commercial brass standard kilogram.

Although the metric system was established in France as the legal system of weights and measures in 1799, it was not until more stringent provisions of law for enforcing its exclusive use were passed in 1837, that metric weights and measures began to be generally adopted in that country. Since that period it has been gradually adopted in other countries, and there is now every prospect of its finally becoming universally in use, and being acknowledged as an international system of weights and measures. Attention has been already drawn in NATURE, vol. vii. p. 197, to the proceedings of the International Metric Commission at Paris for the construction of uniform metric standards for all countries who have adopted or contemplated the adoption of the metric system, as well as to the material, an alloy of platinum and iridium, adopted for the new standards, and the peculiar form of the new International standard metre. It will therefore be sufficient here merely to show the adopted form of the new standard metres, as compared with that of the existing Standard Metre des Archives, in the following figures, all of the actual size:

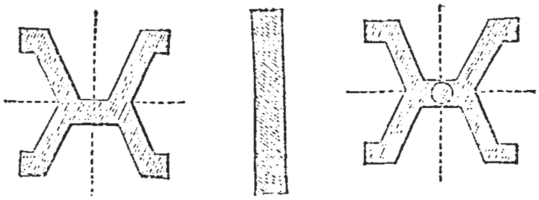

FIG. 14.—Form of New Standard Metres.

The form of the new International kilogram will be the same as that of the Kilogramme des Archives, a cylinder of equal diameter and height, with the edges slightly rounded, as already described.

H. W. CHISHOLM

(*To be continued.*)

NOTES

A LETTER has been addressed by Dr. Anton Dohrn to the Colleges, and other bodies of the University of Oxford, giving an account of the cost, extent, and purposes of his zoological establishment at Naples, pointing out the incalculable advantages furnished by the establishment to students of biology, and urging that at least one out of the many fellowships belonging to Oxford should be devoted to the purpose of affording a suitable man the opportunity of pursuing the practical study of biology at the Naples station. We have already printed the Report presented to the British Association by M. Dohrn, from which it will be seen that the University of Cambridge has hired a table; we believe the University of Oxford has refused to do so, and hence this appeal to the separate Colleges, by M. Dohrn. Let us hope that at least one of these bodies will come forward and maintain the credit of the University.

Prof. Henrici's Introductory Address for the session at University College, delivered on Thursday last, dealt chiefly with the distinction between the results of Mathematical teaching in Germany and in England; that while in Germany almost every great mathematician (as an example the late Prof. Clebsch was pointed out) was the founder of a school, in England, on the contrary, no mathematical school had been founded in recent times. This the lecturer did not attribute to the paucity in this country of mathematicians of the very highest eminence,—indeed the names of Sylvester, Cayley, and Sir Wm. Thomson are alone sufficient to show that no country of Europe is ahead of England in this respect,—but rather to the want of personal influence exercised by them on younger minds, which has become almost impossible by the antiquated institutions of our old Universities. While the number of mathematical students at Cambridge exceeds that at a large number of German universities put together, the proportion of these students who are pursuing their studies for any higher purpose than that of taking a good degree—after which they allow them to be all but entirely neglected—is very small; and hence England is lamentably deficient in mathematical inquirers of the second and third class. Without wishing to see the German system introduced into this country in its entirety, Prof. Henrici pointed out some of the defects of our English system which he considered to conduce to this end; especially the encouragement given by the mode of examination to "cramming;" the small number of professorships; the fact that the remuneration of the professors is to a great extent dependent on the student's fees, and hence the comparatively high scale of charges; the slight encouragement given to the pursuit of pure science as a means of livelihood; and, above all, the want of that personal communication and interchange of ideas between teacher and pupil which tends so greatly to a promotion of the love of science.

A special Meeting of the Council of the Society of Arts was held on Wednesday, Oct. 1, to consider the subject of National Museums and Galleries, and their bearing on public education. A Standing Committee was appointed for the purpose of bringing under Parliamentary responsibility the national museums and galleries, so as to extend their benefits to local museums, and to make them bear on public education. The following are the several objects in view for effecting this purpose:—1. All museums and galleries supported or subsidised by Parliament to be made conducive to the advancement of education and technical instruction to the fullest extent, and be made to extend their advantages to the promotion of original investigations and works in science and art. 2. To extend the benefits of national museums and galleries to local museums of science and art which may desire to be in connection, and to assist them with loans of objects. 3. To induce Parliament to grant sufficient funds to enable such objects to be systematically collected, especially in view of making such loans. 4. For carrying out these objects most efficiently, to cause all national museums and galleries to be placed under the authority of a minister of the Crown, being a member of the Cabinet, with direct responsibility to Parliament; thereby abolishing all unpaid and irresponsible trustees, except those who are trustees under bequests or deeds, who should continue to have the full powers of their trusts, but should not be charged with the expenditure of Parliamentary votes. 5. To enter into correspondence with all existing local museums and the numerous schools of science and art (including schools for music) now formed throughout the United Kingdom, and to publish suggestions for the establishment of local museums. 6. Also to cause the Public Libraries and Museums Act (18 and 19 Vict. c. lxx.) to be enlarged, in order to give local authorities increased powers of acting. We congratulate the Society of Arts on the step it has taken: we believe it is the most important piece of work it has ever set its hands to.

The Council of the Society for the Promotion of Scientific Industry, looking to the enormous waste there is in the consumption of coal, whilst its cost is every day increasing, have resolved that an exhibition shall be held in Manchester of all appliances and apparatus, that tend to the economic use and saving of fuel, for the purpose of inducing attention to, and eliciting opinions of practical men on the matter, and of giving all consumers of coal an opportunity of comparing the various appliances, with a view to their adoption of that which will best serve their purpose. The exhibition will comprise:—1st. Appliances which may be adapted to existing furnaces, &c., whereby an actual saving is effected in the consumption of fuel. 2nd. Appliances which may be adapted to existing furnaces, &c., whereby waste heat is utilised. 3rd. New steam generators and furnaces, boilers and engines specially adapted for the saving of fuel and appliances, whereby waste products are utilised, and the radiation of heat prevented, &c., &c. The exhibition will include appliances used for manufacturing, agricultural, and domestic purposes. Either the apparatus itself, or diagrams, or models may be exhibited, and no limit is placed upon the class of articles to be exhibited. Exhibitors will be required to deliver their exhibits free of charge at the place of exhibition, and to remove them at the close of the exhibition; they must also erect them if necessary at their own expense. Every exhibit must be accompanied by a full description, which must include a statement of the particular work the apparatus is intended to perform. A duplicate of this statement must be handed in when application is made to exhibit. Exhibitors will be given every opportunity of explaining the speciality of their apparatus. All articles are exhibited at the risk of the exhibitor, though every reasonable care will be exercised. Further information may be obtained from the secretary of the society.

Sir Samuel and Lady Baker, with their nephew and some black servants, arrived at Paris on Monday morning, *en route* for London. The whole of them are in excellent health, and bear strong traces of exposure to an African sun. Interesting information concerning Sir Samuel's work in Africa, will be found in the *Daily News* of the 7th and 8th inst.

Sir Henry Rawlinson delivered the inaugural address on the commencement of the winter session of the Midland Institute at Birmingham on Monday evening. Referring to Arctic explorations, he said he indulged the hope that the year will not close before an assurance has been given that the *Challenger* Expedition will be supplemented by the despatch during next spring of a well-equipped Admiralty vessel which will be commissioned to endeavour to reach the Pole by pushing through Smith's Sound from Baffin's Bay in the track of the American ship, *Polaris*, whose fate has recently elicited so much sympathy throughout England.

Surgeon E. J. Milligan, of the steamship *Africa*, writes from Sierra Leone, on the 12th ult., to the *Irish Times*, stating that on August 17, when returning from Loanda homeward, they steamed up the River Congo, and when at Banana one of the passengers, M. Cressy, received a letter from a friend stationed 300 miles up the river. It contained the intelligence that about 200 miles farther in the interior a white man, accompanied by a number of native attendants, was proceeding in the direction of the West Coast. His supplies becoming short, he was prevented from proceeding by a tribe, and retained prisoner until some should be secured. From the description given by the native traders to M. Cressy's friend of this person, and also from the fact that no other white man is known to be in this region, it is generally inferred that it is Dr. Livingstone.

WE regret to record the death of Sir Paul Edmund de Strzelecki (perhaps better known as Count de Strzelecki) who died on Monday morning at his residence in Savile Row, at the age of 77 years. Early in life he was a great traveller, and explored a great portion of Australia. He was elected a Fellow of the Royal Society in June, 1853, was a D.C.L., and a member of several of our learned societies.

PROF. WATSON, of Ann Arbor, telegraphs to the Detroit *Tribune:* "On July 24 I observed a star of the twelfth magnitude, which, on Saturday night last (August 16), was missing from the place where first seen. A little to the west I saw a star of the eleventh magnitude, which proves to be the new planet (No. 133), and at present I suppose it to be that seen July 24."

THE Fungus-show at the Royal Horticultural Society on Oct. 1st was a great success; never had there been a greater or better arranged display of these plants, classified under the two sections of "edible" and "poisonous." A new economical use for this class of plants was indicated by the Rev. Mr. Berkeley, who produced a cap made out of the beaten out interior mass of *Polyporus fomentarius*, the amadou or German tinder of commerce, which he described as both warm and light. It is stated that large use is made in Hungary of this material for caps and waistcoats, and it is also used for caulking boots.

ONE of the important and beautiful publications which characterise the Smithsonian Contributions to Knowledge is just issued under the title of "A Contribution to the History of the Freshwater Algæ of North America," by Horatio C. Wood, jun., M.D.

NOW that so much attention is being paid to the introduction into our colonies of useful foreign trees and crops, we desire to call special attention to the publication at Brisbane of "The Olive and its Products: a treatise on the habits, cultivation, and propagation of the tree, and upon the manufacture of oil and other products therefrom," by L. A. Bernays, F.L.S., Vice-President of the Queensland Acclimatisation Society. The work has special reference to the advantages to be derived from the introduction of the olive into Queensland, and is printed and published at the expense of the Colonial Government.

NEWS has been received to the date of May 1, from Mr. Henry Elliott, who has been engaged for two years past in making explorations and observations in the fur-seal islands in the Behring Sea. He announces the continued prosecution of his labours, the results of which were transmitted to the National Museum in the summer of 1872. He has especially devoted himself to an investigation of the habits of the fur-seal, walrus, and sea-lion, and has made a topographical survey of the rookeries upon a portion of the islands on which these animals come to bring forth their young. His work in 1872 was devoted mainly to St. Paul Island, but he expected, very soon after the date of his letter, to visit St. George and the other islands of the group, there to prosecute similar inquiries.

WE consider it extremely creditable to the *Leeds Daily News* that it chronicles regularly and at considerable length the proceedings of the Leeds Naturalists' Field Club and Scientific Association, and we should like to see other provincial, and indeed metropolitan papers follow its example. The principal paper read at the Society's meetings during September was by Mr. James Abbott, on the structure and development of the Hepaticæ. The Society continues, we are glad to see, to investigate very thoroughly the natural history of the district.

WE heartily endorse the following sentiment of the *Athenæum* in reference to the meeting of the British Association:—"The opinion is gradually forcing itself upon many of those who attend the meetings of the Association that some change in its method of procedure is becoming necessary. For the scientific men, on whom rests, more or less, the responsibility of keeping up the sectional business, either by doing official work or attending the meetings and taking part in the discussions, the labour is too exacting on an occasion which should have something of relaxation about it. Again, the tendency of the papers is necessarily to take a technical direction, which must put them beyond the range of the non-scientific audience. The sectional business is consequently unsatisfactory, both to those who take part in it and to those who attend as listeners. The Association should fulfil two functions—first, that of bringing together scattered scientific men, who otherwise rarely or never meet; secondly, of giving the general public some idea of what the scientific world is doing. For the first object, more leisure is required during the meetings—more opportunity of talking over amongst themselves the work which different men are occupied with. To attain the second object, instead of miscellaneous papers, short addresses, carefully prepared, might be delivered, with one or two invited speakers to follow. These addresses should be given at morning meetings, which might advantageously break up at one, leaving the afternoons free.

MESSRS. SAMPSON LOW, MARSTON, and Co. announce the following books to be published during the forthcoming season:—"The Heart of Africa; or, Three Years' Travels, Discoveries, and Adventures in the Unexplored Regions of the Centre of Africa," by Dr. George Schweinfurth. The district explored by Dr. Schweinfurth embraces the wide tract of country extending southward from the Meschera on the Bahr el Ghazal, and between the 10th and 3rd degrees of north latitude. The work will form two large octavo volumes, and will be illustrated by about 130 woodcuts from drawings made by the author during his journey.—"A Whaling Expedition to Baffin's Bay and the Gulf of Boothia. With an account of the rescue by his ship of the survivors of the crew of the *Polaris*," by Captain Markham, with maps and illustrations. The maps to this work will give the first authentic delineation of Hall's discoveries, and also contain several important corrections of the old charts.—"The Land of the White Elephant; or, Lights and Scenes in South-Eastern Asia," being a personal narrative of travel and adventure in Farther India, embracing the countries of Burma, Siam, Cambodia, and Cochin-China, by Frank Vincent, jun., with maps and plans.—"The Wild North Land," a winter journey with dogs across Northern North America, by Captain W. F. Butler, with a map; and a new work on Peru by Thos. J. Hutchinson, F.R.G.S., entitled, "Two Years in Peru, with Exploration of its Antiquities."

MESSRS. TRÜBNER'S List of forthcoming books includes the following scientific works:—"From the Indus to the Tigris:" a narrative of a journey through the countries of Balochistan, Afghanistan, Khorassan, and Iran in 1872; together with a synoptical grammar and vocabulary of the Brahoe language, and a record of the meteorological observations and altitudes on the march from the Indus to the Tigris, by H. W. Bellew, C.S.I., Surgeon to the Bengal Staff Corps. "The Rod in India;" being hints how to obtain sport, with remarks on the natural history of fish, otters, &c., and illustrations of fish and tackle, by H. S. Thomas, F.L.S., F.Z.S. A third and enlarged edition of the "Celt, the Roman, and the Saxon," a history of the early inhabitants of Britain, down to the conversion of the Anglo Saxons to Christianity, illustrated by the ancient remains brought to light by recent research, by Thomas Wright, M.A., F.S.A.

A DEPUTATION from the Trades' Guild of Learning waited on Tuesday afternoon on a Sub-Committee of the London School Board, at the invitation of the School-Management Committee, in order to urge upon the Board the adoption of systematic training in mechanics, &c., with the object of adapting the scientific instruction, provided or contemplated in the Board schools, to the future employments of the children. A memorial to the same effect has been presented to the Board, and is now under their consideration, in favour of the elementary teaching of applied science and art in the schools, in such a manner as to lay the foundation of a connected system of technical education.

NEWS has been received of the death at Quito, Ecuador, in June last, of Dr. William Jameson, an eminent naturalist, who resided for many years in Quito as a professor of chemistry and botany in the University. His contributions, both in zoology and botany, to public institutions in America and Europe have been very extensive.

DR. DAVID MOORE reprints from the "Proceedings of the Royal Irish Academy" a complete Muscology of Ireland, under the title "Synopsis of all the Mosses known to inhabit Ireland up to the present time."

THE additions to the Zoological Society's Gardens during the past week include two Black-headed Parrots (*Caïca melanocephala*) from Demerara, presented by Judge Lovesy; a Brown Bear (*Ursus arctos*), European, presented by Mr. M. B. Wilson; a Thicknee (*Oedicnemus crepitans*), British, presented by Mr. Patey; a Lesser Black-backed Gull (*Larus fuscus*), British, presented by Mr. C. W. Wood; a Hairy Armadillo (*Dasypus villosus*), from River Plate; a Burrowing Owl (*Pholeoptynx cunicularia*), from the same place, deposited; a Wattled Crane (*Grus carunculata*), from Africa, and two Bataleur Eagles (*Helotarsus ecaudatus*).

THE BRITISH ASSOCIATION

SECTIONAL PROCEEDINGS

SECTION A.—MATHEMATICS AND PHYSICS

On Etherial Friction, by Prof. Balfour Stewart, LL.D., F.R.S.

Professor J. C. Maxwell has made a series of experiments on the friction of gases. In these experiments a horizontal disc was made to oscillate in an imperfect vacuum near a similar disc at rest, and it was found that the motion of the oscillating disc was carried away by the residual gas of the vacuum at a rate depending on the chemical character of the gas, and depending also upon its temperature, but nevertheless independent of its density.

While the temperature of the arrangement remained constant, it was found by Prof. Maxwell that this fluid friction was rather greater for atmospheric air than for carbonic acid, while for hydrogen it was, I think, about half as great as for air.

On the other hand, when the temperature was made to vary the result was found to be proportional to the absolute temperature.

These experiments do not show that there is no such thing as etherial friction, that is to say, friction from something which fills all space, and is independent of air; but we may argue from them that such an etherial friction must either have been nearly insensible in these experiments, or it must, as well as the friction from the gas, have varied with the absolute temperature, in which case the two frictions would not be separated from one another by the method of the experiment.

Prof. Tait and myself have made some experiments upon the heating of a disc by rapid rotation in vacuo. In these experiments we found a mere surface heating due to air which varied not only with the quality, but also with the quantity of the residual gas; and we also found a surface effect (more deeply seated however than the former), which appeared to be a residual effect, and which it is possible may be due to etherial friction. We made no experiments at varying temperatures, but we made use of various residual gases, and we found that the heating effect for carbonic acid was perhaps a trifle less than for air, while that for hydrogen appeared to be about four times less than that for air. Now comparing Prof. Maxwell's experiments with ours, we have in the former a stoppage of motion which is rather less for carbonic acid than for air, and about half as large for hydrogen as for air. In the latter again we have a heating effect rather less for carbonic acid than for air, and only about one-fourth as large for hydrogen as for air. Thus it appears that the stopping effect of hydrogen in Prof Maxwell's experiments is relatively greater in comparison with air than is its heating effects in our experiments, when compared with that of air. The effects of these various gases would bear to one another more nearly the same proportion in both experiments, if we might suppose that in Prof. Maxwell's experiments there was mixed up with gaseous friction a very sensible etherial friction; but in that case it would be necessary to suppose that the etherial friction was proportional to the absolute temperature.

During the meeting of the British Association at Edinburgh, I brought before this section reasons for imagining that if we have a body in visible motion in an enclosure of constant temperature, the visible motion of the body will gradually be changed into heat. The nature of the argument was such as to render it probable (although not absolutely certain) that in such a case the rapidity of conversion will be greater the higher the temperature of the enclosure.

I will now refer to some experiments by Prof. Tait which formed the subject of the last Rede Lecture. These experiments were suggested to Prof. Tait by an hypothesis derived from the theory of the dissipation of energy which led him to think that the resistance of a substance to the conduction of electricity, and also of heat, would be found proportional to the absolute temperature. Mattiessen and Von Bose in the case of electricity, and Principal Forbes in the case of heat, had already proved that as a matter of fact the law was not very different from that imagined by Prof. Tait. The result of these experiments has been to confirm the truth of this law.

The following considerations also connected with the dissipation of energy point to the same conclusion. Perhaps we may regard the etherial medium as that medium whose office it is to degrade all directed motion, and ultimately convert it into universally diffused heat, and in virtue of which all the visible differential motion of the universe will ultimately be destroyed by some process analogous to friction.

Now in order to imagine the way in which either may possibly act in bringing about this result, let us imagine some familiar instance of directed motion, as for instance a railway train in motion. The train, let us suppose, and the air in it, are both in rapid motion, while the air outside is at rest. Now as the train proceeds, suppose that a series of cannons loaded with blank cartridges are fired towards the train. A series of violent sounds will go in at the one window, and out at the other of each carriage. Each sound will push some air from the stratum of air at rest into the carriage on the one side, and it will push some air from the carriage into the stratum at rest on the other side. Now in this operation it would seem that part of the visible motion of the train must be taken from it. To make another comparison, it is as if a series of individuals were jumping into the train at the one side, and out of it at the other, the result being that each carries away so much of the motion of the train, and therefore renders it difficult for the engine to drive the train. Each individual comes to the ground with an immense forward impetus, and rubs along the ground till this is lost; in fact, he carries with him so much motion of the train, and converts it into heat by friction against the ground.

Now something similar to this must happen to a substance in visible motion in an enclosure of constant temperature. The rays of light and heat will play very much the same part as the waves of sound, or as the crowd of people in the above illustration, at least if we except those which fall perpendicularly